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**MARKETS, MOTIVATIONS AND PUBLIC GOODS:
EXPERIMENTAL INVESTIGATIONS ON THE IMPACT OF INSTITUTIONS**

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Abstract

There are many factors which can motivate people to contribute to public goods. These range from intrinsic motivations such as altruism, through social motivations such as concerns for fairness and approval, to extrinsic incentives which include sanctions and payments. Institutions help determine how these motivations are applied and expressed. Psychological studies indicate that extrinsic incentives can crowd out the intrinsic motivations which prompt voluntary contributions to public goods. We applied experimental economics techniques to examine how people in a public good dilemma respond to changing institutions. Our results showed that the introduction of formal institutions (a regulation and competitive tender) crowded out voluntary contributions, with the supply of public good increasing less than anticipated, and in some circumstances actually decreasing. In particular, the introduction of the competitive tender triggered a 'market instinct', with participants who previously had been expressing social preferences now seeking to maximise profits. The effects of crowding out persisted even after an institution was removed, suggesting that it may be difficult to reverse. We conclude that policy makers should tread carefully when considering formal institutions to promote public good provision, particularly where desired actions are already occurring voluntarily to some extent.

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Motivations and Public Goods

When faced with contributing to the provision of a public good, an individual's Nash strategy is to contribute nothing if the private costs of contributing exceed the private benefit from that extra contribution. However, observational and empirical evidence shows that many people systematically deviate from this theoretical prediction by making costly voluntary contributions. For instance, people donate to charity, help strangers and spend time and money improving the environment. Such behaviour is also apparent in economic experiments, where many participants are prepared to forego some personal income in order to increase the income obtained by others.

There are different reasons for people to make voluntary contributions to public goods. Some are likely to simply be miscalculating the payoffs; Andreoni (1995) estimates that around half of observed cooperation among experimental subjects is down to confusion rather than deliberate choice. Some may contribute out of pure altruism, seeking to benefit others whilst receiving no benefit themselves; such behaviour is rarely observed in experiments (Ostrom 1998). Voluntarily contributing to public goods may give people a "warm glow" (Andreoni 1989 – this is impure altruism as they are deriving some benefit themselves). In psychological terms, making voluntary contributions can improve a person's self image – this was recognised as a motivating factor by Adam Smith (Benabou & Tirole 2006). Recent neurological studies suggest that cooperating with others can be inherently rewarding. MRI scans show that cooperation in prisoners' dilemma games stimulates areas of the brain associated with reward processing (Rilling *et al.* 2002). Rilling *et al.* (2002) found that mutual cooperation appeared more stimulating than the more profitable outcome of defecting while the other player cooperated. This suggests there may be an underlying physiological basis to the warm glow hypothesis. When compared to other explanations for contributing to binary public goods, such as regret, a warm-glow theory has been found superior in taking into account a degree of altruism and subjects' general inability to normalise the value of uncertain public goods (Pérez-Martí & Tomás 2004).

There is considerable experimental evidence that some people are motivated by a concern for fairness, being concerned not just by their own contributions and payoffs, but also those of others. They may value outcomes they perceive as fair, even if it involves them receiving less money than they otherwise might (see, for example Berg *et al.* 1995, Fehr and Schmidt 1999, Falk *et al.* 2003). People are also willing to punish actions by others which they perceive as unfair, even if such punishment is costly (Fehr & Gächter 2000). This sort of punishment can be considered altruistic because it creates strong incentives for individuals to cooperate (Fehr & Gächter 2002). This increased cooperation benefits all, while the costs of imposing punishment are borne only by the punisher. Altruistic punishment has also been shown to stimulate reward areas of the brain (de Quervain *et al.* 2004). This suggests that satisfying social preferences such as a concern for fairness may be inherently rewarding, providing its own "warm glow".

A desire for approval from others can also be important (Kopelman *et al.* 2002) – people have been shown to raise their contributions simply in response to others anonymously expressing 'disapproval' of their actions (Masclét *et al.* 2003). Gächter and Fehr (1999) found that social approval had little effect in increasing contributions among strangers, but if even weak social ties or group identity were formed approval incentives significantly reduced free riding. Social approval appears to be important in many public good decisions in life. People who have donated to good (or popular) causes often identify themselves with pins, T-shirts or certificates, while many charities publicly identify major donors. The lengths that most experimentalists go to ensure anonymity for their subjects suggests that social approval must be considered important (Andreoni & Petrie 2004). Indeed, identifying contributors, and the amounts they contribute, leads to significantly higher contributions in public good games (Andreoni & Petrie

2004).

In a repeated interaction scenario, contributing to a public good can encourage others to contribute themselves, which in the long run may make the contributor (and everyone else) better off. When faced with unfamiliar situations, people will commonly look to imitate the actions of others. This means that norms of behaviour are pre-disposed to emerge, and individuals may be able to benefit from encouraging such norms to be cooperative rather than non-cooperative. If cooperation is intended as a signal to encourage others to cooperate in future rounds, then the incentives to send such a signal will decline through time (as there are fewer rounds remaining), resulting in a gradual decline in observed cooperation (Holt & Laury 1997). This may explain the observation that the rate of decline in cooperation in public good games over repeated rounds is inversely related to the number of rounds (Ostrom 1998).

People can also be motivated to contribute by more formal incentives. Payments may be used to subsidise contributions, or regulations to mandate a minimum contribution. Such incentives are extrinsic, that is they are dependent on external rewards or sanctions, as opposed to intrinsic incentives that are inherent to an individual (Deci 1971). As shown in Figure 1, the factors motivating contributions to a public good can be characterised according to the degree to which they are intrinsic or extrinsic. Altruism is entirely intrinsic, while payments are extrinsic. Encouraging reciprocity from others is largely extrinsic. “Warm glow” rewards are largely intrinsic, although they may be affected by external factors such as social norms. Desire for approval and concern for fairness are intermediate, as they are strongly influenced both by internal personal values and external social norms. These motivations can also be considered on a continuum of increasing social and institutional context. Pure altruism is largely self-defined and based on personal values, while social preferences will depend on a combination of personal and societal values. Formal incentives such as regulations are entirely a product of society rather than the individual.

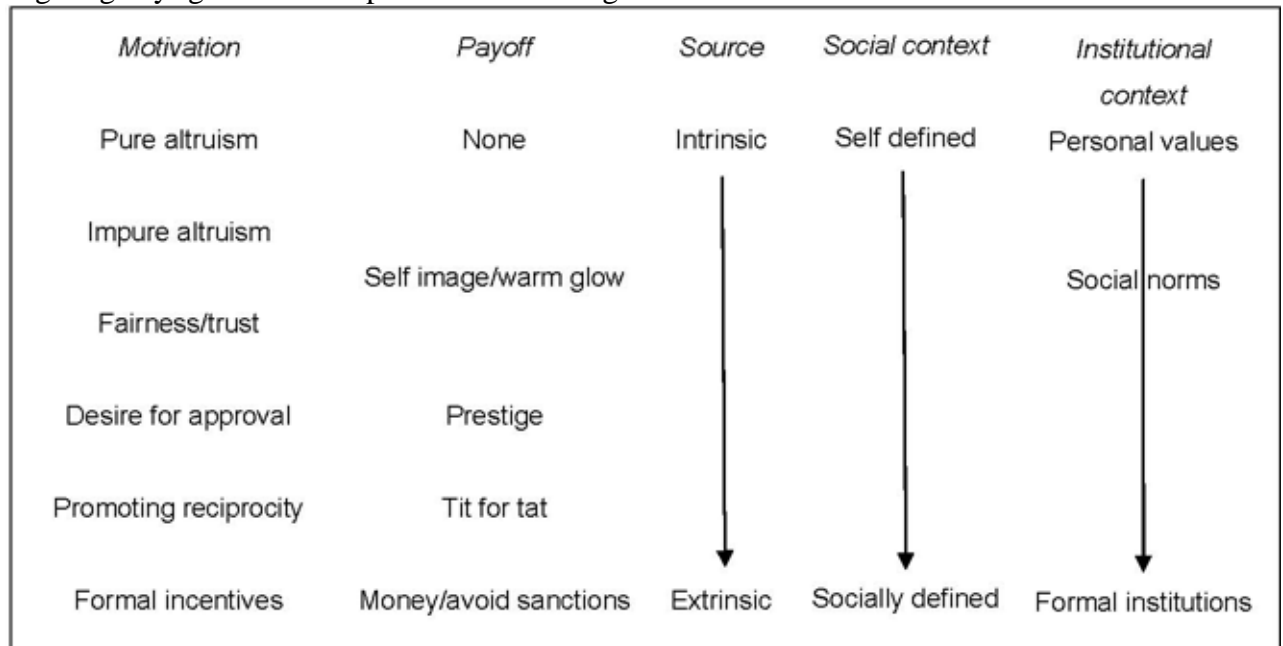
Figure 1: Motivations for contributing to a public good

Institutions and Motivations

Institutions are the norms, rules and organisations that shape the way in which people interact. They provide the incentives to which people respond when making decisions. However institutions are not simply passive transmitters of incentives. They can affect people’s motivations, and change the way in which they make their decisions. Formal institutions typically focus on extrinsic motivations, providing financial or regulatory incentives to achieve desired outcomes. However these incentives can also impact on intrinsic motivations. Cognitive evaluation theory suggests that intrinsic motivation consists of two elements (Deci & Ryan 1985). The most important is an individual’s sense of autonomy; people are more satisfied if they perceive they are doing an activity for their own reasons rather than being controlled externally. The second element is a need to feel competent at an activity. Extrinsic rewards can be interpreted as controlling behaviour, reducing an individual’s sense of autonomy, and can therefore crowd out intrinsic motivation (Deci 1971). However, this may be offset to some extent if a reward is also seen as acknowledging competence at an activity. A meta-analysis of the psychology literature indicates that paying an external reward tends to reduce an individual’s intrinsic motivation, while positive feedback (typically ‘verbal rewards’) increases it (Deci *et al.* 1999).

Attributional approaches provide a different, although not necessarily mutually exclusive, psychological mechanism for motivational crowding. Where a reward is offered, people may attribute their behaviour to the reward, and come to believe that the task is not inherently worthwhile (Leper *et al.* 1973). Individuals have a self-image which is shaped by their actions.

Pro-social behaviour can lead to an improvement of an individual's self image. However, if an extrinsic reward is introduced, it will no longer be clear whether the behaviour is being performed as a 'good deed' or for a reward. This reduces the self-image enhancing value of the activity. An individual's desire for approval from others can be affected in a similar way. Performing a pro-social activity without reward is clearly identifiable as altruism. However, once a reward is attached this is no longer the case – individuals driven solely by the reward may become associated with the activity, reducing the reputational advantage gained by altruists (Benabou & Tirole 2006). These psychological theories suggest that formal institutions have the potential to crowd out intrinsically motivated contributions toward a public good (Frey & Oberholzer-Gee 1997). They can be seen as controlling, reducing autonomy, and negating any 'good deed' aspect of contributing.



Institutions set the context within which people make decisions, and can therefore determine which set of values, norms and behaviours are applied. For instance, concepts of fairness, which are an important motivating factor, are inherently social norms, with different norms applying to different contexts. The way in which a situation is framed will therefore determine what behaviour is considered appropriate. People build up a repertoire of behaviours relevant to different circumstances; institutions provide the cues for which behaviour is applied in any given situation, such as whether it is competitive or cooperative, friendly or hostile. For example, in the prisoners' dilemma people are more likely to cooperate if the game is framed in 'cooperative' rather than 'competitive' terms (Fehr & Fischbacher 2002). Similarly, framing the ultimatum game¹ as a buying/selling interaction, rather than as dividing an endowment, led to significantly lower offers from proposers (Hoffman *et al.* 1994). Other experiments have shown that experimental participants make a distinction between 'economic' and 'non-economic' situations; in identical social dilemma scenarios, people were less cooperative when the context was 'economic' (Pillutla & Chen 1999). This does not necessarily imply that people are acting irrationally; if they derive utility from acting cooperatively in social contexts but not in economic contexts, utility maximising behaviour will vary with context (Pillutla & Chen 1999).

Market institutions may have a particularly marked effect on social motivations as, unlike most other institutions, they support impersonal, ephemeral interactions (Bowles 1998). In markets, it is usually more difficult to judge intentions; indeed, they are frequently largely anonymous, so the basis for social preferences is much reduced. The competitive nature of markets may trigger people to behave in a self-interested way, rather than in the more cooperative or reciprocal ways in which they behave in other situations. Competition means that in the presence of self-interested agents, there is little that other agents can do to affect the distribution of resources (Sobel 2005; Falk & Fischbacher 2006). As price taking cannot be distinguished from selfish behaviour, it can be difficult to express social preferences in a market setting (Sobel 2005). Bowles (1998) suggests that the market does not make people more selfish, rather it makes them more likely to apply self-regarding than social preferences from their behavioural repertoire. Some agents add social preferences to an existing product which then sells at a premium, for example "fair trade" coffee, but such products tend to be the exception rather than the norm.

¹ In the ultimatum game, one subject (the proposer) is given an endowment (typically \$10), and has the option to transfer some, all or none of the money to an anonymous partner. The partner decides whether to accept the transfer. If the partner accepts, the proposer keeps the endowment less the transfer, and the partner keeps the

transfer. If the partner rejects, both get nothing. The Nash equilibrium is for the partner to accept any positive offer; however, low offers are frequently rejected.

² Since there were 12 participants, each receiving 1/10 of total shared income, public good contributions were effectively subject to a 20% bonus. Total shared income was divided by 10 rather than 12 to keep the calculations simple for the participants. The quiz questions confirmed that participants understood how shared income was calculated, and the nature of the trade-off between private and shared income.

³ The Nash equilibrium is a total of 600, Pareto is 2200.

⁴ This analysis pooled data from the suasion and regulation treatments, which were identical in the initial stage.

⁵ The restart effect in the regulation and suasion treatments limits comparison to the control beyond period four. There were virtually no voluntary contributions in the final stage of the control; therefore it was not possible to test for crowding out against the control treatment.

⁶ Data were analysed using general linear models and LSD post hoc tests.

⁷ The instructions did not use the word 'market'.

When institutions collide...

While most theoretical and empirical studies focus on single institutions, transitions between institutions are also likely to be crucial, especially in considering the design and implementation of public policy. Experimental economics provides a powerful tool for examining how people make decisions. Responses to alternative institutions can be tested and compared under controlled conditions. This can both inform theory and act as a 'wind tunnel' for policy design. We applied experimental economic techniques to test how people in a public goods dilemma respond as institutions change. In our first experiment, we looked at the effect of introducing a formal institution in the form of a regulation. A follow up study examined how people respond following the introduction of a market based instrument (a competitive tender) to a public goods dilemma.

Experiment One

We designed an experimental scenario to examine how contributions to a public good are affected by experience of a formal institution. This took the form of a modified public goods game, with a voluntary contribution mechanism and no communication. Participants trade off private income against contributing to shared income. This represents a public good dilemma as increasing private income leads to a greater reduction in group income. Consistent with public good experimental designs, group income is non-excludable, being shared equally among all participants, regardless of who contributed. Individuals will get more income if everyone contributes to the public good, but each has an incentive to free ride.

In the absence of communication or formal institutions, it is unlikely that participants will be able to completely solve the dilemma and maximise their collective income. Our interest was in how voluntary contributions to collective income are affected by institutions. Does being reminded of the nature of the trade-off strengthen or weaken motivations to contribute? Does being regulated affect voluntary contributions? Based on the theoretical and empirical evidence for crowding, our hypothesis is that experience of a formal regulation will crowd out voluntary contributions to a public good.

Our experimental setting consisted of three treatments. In the baseline treatment, participants went through 12 periods of the public goods game uninterrupted. Based on previous studies, it is expected that voluntary contributions will initially be significantly higher than the Nash equilibrium, but will decline towards it with repetition. The second treatment involved moral suasion, in the form of simply reminding participants that they would all be better off if they all contributed to the public good. It is expected that this will increase contributions in the short term.

The final treatment involved a regulation mandating a minimum contribution unexpectedly introduced before period five and removed after period eight. Beginning both treatments with no formal institution provided an opportunity for social norms to develop. Our hypothesis is tested by comparing contributions in the final stage of the experiments, after the regulation had been removed. In this stage none of the treatments had any formal institution, so any observed differences in contributions can be traced to experience of the regulation in the previous periods.

As well as testing for evidence of institutional crowding, our experiments also examine how individuals respond to changing institutions. Following the introduction of a regulation, do subjects who were contributing more than the original minimum now contribute more than the regulated minimum contribution? Do those who were making large voluntary contributions continue to do so, or do they drop down to the regulated minimum? And what happens when the regulation is removed? Do people behave as they did prior to its introduction, or has their behaviour been changed as a result of experiencing the regulation?

Methods

In the experimental scenario, participants select from five options. Each option is associated with a different level of ‘private income’ and ‘shared income’. ‘Private income’ is paid to the participant who selects that option. ‘Shared income’ is paid into a fund, and each participant receives 1/10 of the total amount. There were six different sets of options, with varying opportunity costs of contributing to shared income. Table 1 shows the private and shared income, in Australian cents, associated with each option. Each participant is assigned to one of the six private income sets. The shared income associated with each option is the same for all participants.

Each session had 12 participants, two for each option set. Subjects only see their own set of options. In each period, participants selected one of the five available options. Participants are paid for each period, in addition to a \$10 show-up fee.

	Private 1	Private 2	Private 3	Private 4	Private 5	Private 6	Shared
Option 1	0	0	0	0	0	0	200
Option 2	20	35	45	55	70	85	150
Option 3	35	55	80	95	115	140	100
Option 4	45	70	95	115	140	170	50
Option 5	48	72	98	118	143	173	0

Table 1: Private and shared income.

As private income increases, the associated contribution to shared income decreases. The Nash equilibrium is option four. Moving to option five increases private income by only 2-3 cents, while reducing shared income by 50 cents. Since each participant receives 1/10 of total shared income, option five is inferior to option four. The Pareto optimum is option one for sets one to four, and option two for sets five and six.

Experiments were carried out at Griffith University in Brisbane, Australia using The Experimental Software System (TESS) and the interface file, Mwater. Participants were recruited from the University's student population through a web-based recruitment system. On arrival at the experiment, each participant was randomly assigned to a computer, provided with a set of instructions in a powerpoint file, and asked to complete a quiz to ensure they understood the experiment. Once a participant answered all the questions correctly, they received a password enabling them to access the experiment.

Computer screens show the five options available to the participant. At the beginning of each period a box appears, into which participants enter their chosen option. After 30 seconds the box disappears, and screens are updated to show the option selected, the private and shared income associated with it, the total shared income and the money earned by the participant in that period. There was also a running total of income earned. Information from previous periods remained visible throughout the experiment. There were 12 periods in total, which was not known to participants in advance. Three different treatments were independently tested, with three replicates carried out of each.

Control Treatment

A control treatment was carried out in which participants were provided with basic instructions explaining the scenario, prior to running all 12 periods uninterrupted.

Suasion Treatment

An additional page ('suasion page') was added at the end of the instructions. It read:

If everyone selects the option which has the highest total (ie private + shared) income you will all make more money than if everyone selects the option which has the highest private income.

Participants were required to read the suasion page prior to starting the experiment, and re-read it after periods four and eight.

Regulation Treatment

In the regulation treatment, participants were told after period four:-

A rule will now be introduced in order to promote higher incomes for all players.

From now on, you must contribute at least 100 cents of shared income in each round.

You may, if you wish, select an option that contributes more than 100 cents of shared income. But you may not select an option that contributes less.

This was followed by a repeat of the suasion page. The experiment then continued as before, except that participants had to contribute at least 100c to shared income (ie choose only options 1-3). The software would not accept decisions that did not comply with the regulation. After period eight participants were asked to read another set of instructions. They were told that the regulation was being discontinued, and the experiment would continue in the same way as in the initial periods. They were again shown the suasion page. The experiment then resumed and proceeded for another four periods. The timelines for the various treatments are shown in Table 2. Participants were paid their experimental earnings in cash, confidentially, at the end of the session.

	<i>Periods 1-4</i>	<i>(Stage 1) Periods 5-8</i>	<i>(Stage 2) Periods 9-12</i>
	Control		
	Suasion	Suasion only	Suasion only
	Regulation	Suasion only	Suasion and 100c minimum contribution

(Stage 3)

No institution

Suasion only

Suasion only

Table 2: Timelines for the various experimental treatments.

Results

Figure 2 shows the total public good production per period (mean across replicates) by treatment, across all 12 periods.³ The suasion and regulation treatments were interrupted after periods four and eight. In the control treatment, with no suasion or regulation, there was a small but significant level of voluntary contribution. Overall, mean contributions for each player were significantly greater than the Nash equilibrium (observed = 63.2 per player per period; Nash = 50; $t=3.31$; $p=0.002$). In the control treatment, public good contributions declined significantly through time ($p < 0.001$), reaching the Nash equilibrium level by the latter periods.

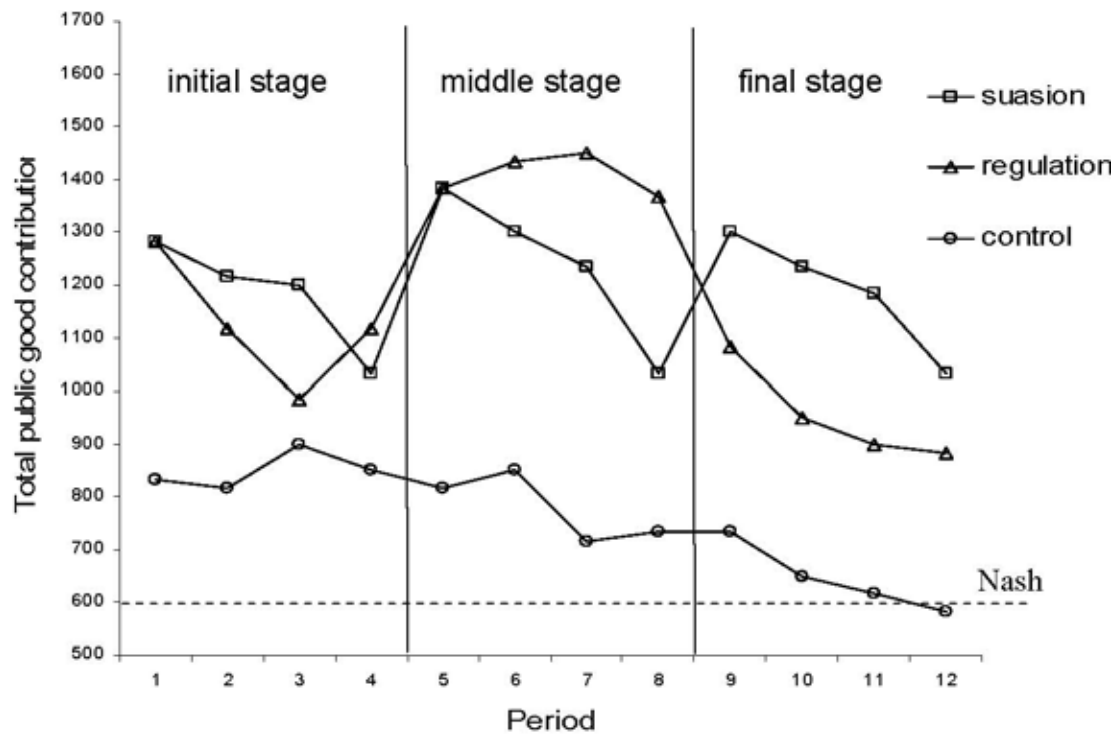
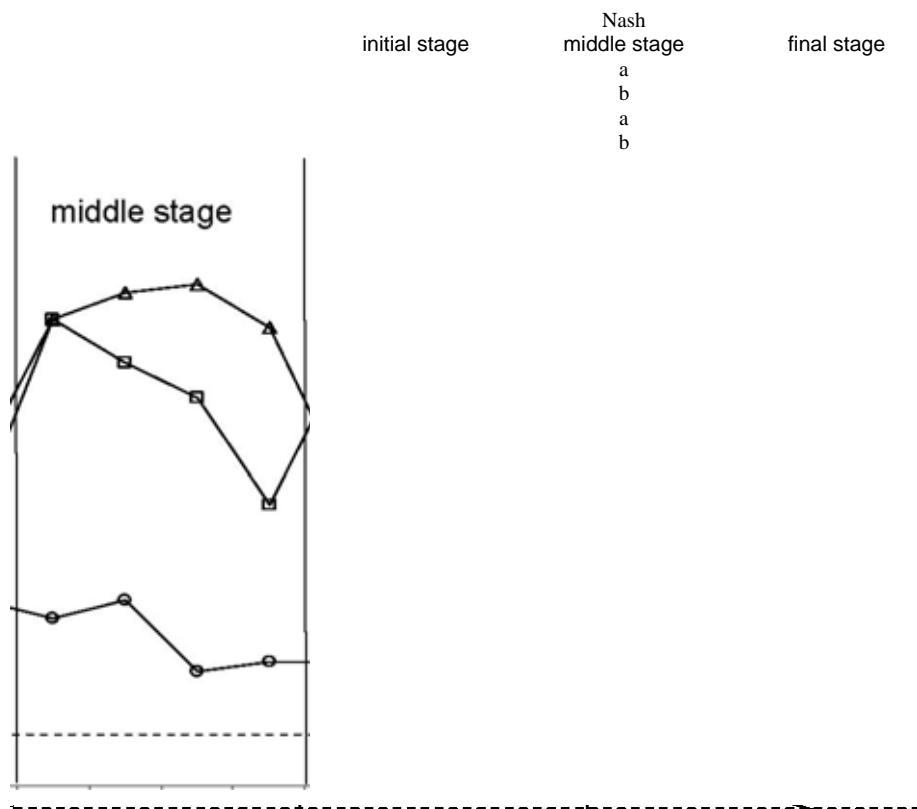


Figure 2: Mean total public good contributions, by period

Figure 3 shows the individual contributions to the public good by treatment for the first (periods 1-4), middle (periods 5-8) and final (periods 9-12) stages of the experiments. The suasion treatment significantly increased public good contributions in the initial period, compared to the control ($F=13.61$, $p<0.001$). By the fourth period, this difference was less pronounced, but still significant ($F=6.52$, $p=0.038$)⁴. Therefore even after four periods, suasion still has a positive effect on contributions. Within each stage of the suasion treatment, contributions declined significantly over the four periods ($F = 5.66$; $p < 0.001$). However there was no evidence of differences in contributions between stages ($F=0.09$; $p = 0.927$). Repeating the suasion page had a 'groundhog day' effect, with contributions each time returning to approximately the level seen in the first period, then declining at a similar rate over the subsequent three periods.



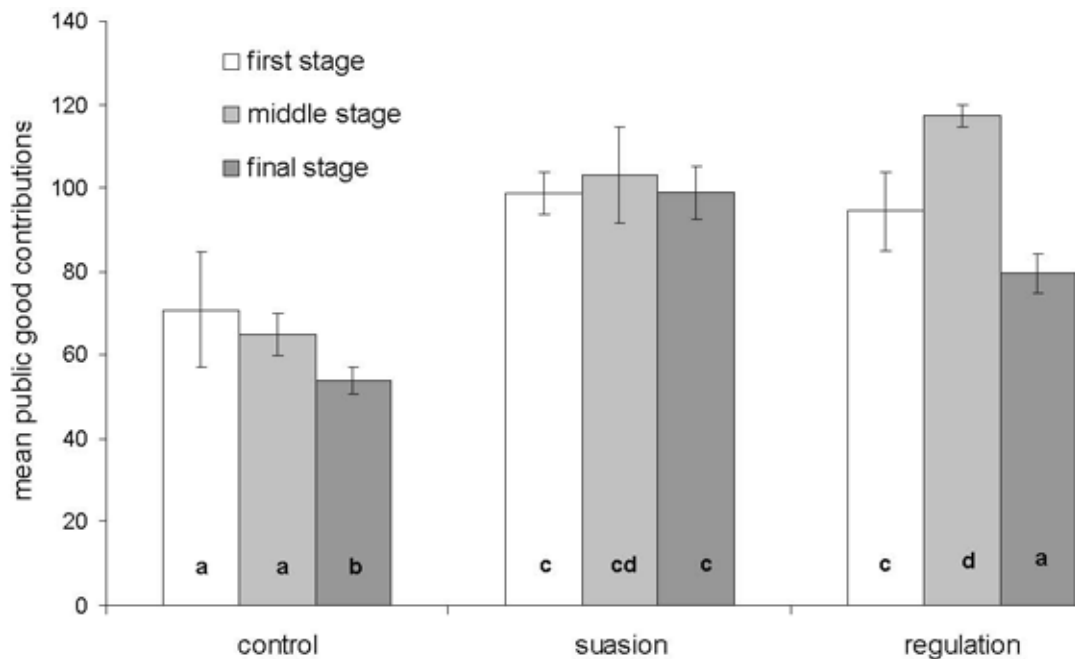


Figure 3: Mean individual contributions, by stage. Bars indicate means (+/- standard deviations) of the replicates for each treatment. The regulation was active only in the middle stage. Bars with different letters are significantly different at the 5% level, based on ANOVA and comparison of the least significant differences of the means.

In the regulation treatment, contributions again declined significantly between periods within a stage ($F=2.37$; $p = 0.024$). While the regulation was in place (during the middle stage) contributions were significantly higher than in the initial stage ($F=5.59$; $p < 0.001$). After the regulation was removed contributions fell sharply, and were significantly lower than in the initial stage ($F=3.37$; $p = 0.002$). Contributions were significantly lower in the final stage of the regulation treatment than in the corresponding stage of the suasion treatment ($F=4.96$; $p < 0.001$). This indicates that experience of being regulated results in significantly lower voluntary contributions once the regulation is removed.

Average contributions by individual participants were examined to check that individual behaviour showed the same pattern. A generalised linear model was run, analysing the responses by individual players in the final stage of the experiment (mean contribution in periods 9-12) against contributions in the initial stage (mean contribution in periods 1-4) and the relative opportunity cost of contributing. Contributions in the last stage were significant in explaining contributions in the initial stage ($F=8.44$, $p < 0.001$), indicating that individuals were showing consistent patterns of behaviour through the experiment. Again, contributions in the final stage were significantly higher in the suasion treatment than in the regulation treatment, even after accounting for differences in initial contributions ($F=3.99$, $p < 0.001$). Relative opportunity cost proved non-significant ($F=0.26$, $p=0.79$).

The effect of changing institutions on individual contributions was examined by dividing individual subjects into four groups based on their average contributions in the first phase of the experiment (prior to the introduction of any institution). The groups were defined by mean contributions: i) greater than 100c; ii) equal to 100c; iii) between 51c and 99c; iv) equal to or less than 50c. Figure 4 shows how contributions varied in subsequent phases. In the suasion treatment, mean contributions by members of each group remained relatively constant between phases (Figure 4a). The regulation mandated a minimum contribution of 100c during the middle phase, forcing those who were initially below this to contribute more. Figure 4b shows that those who were contributing less than 100c in the initial phase contributed on average barely more than the minimum amount under the regulation. Those who had initially contributed 100c per period raised their contributions by an average of 19c under the regulation, while those who had contributed the most prior to the regulation did not raise their average contributions at all. When the regulation was removed in the final phase, all four groups reduced their average contributions. There was a particularly marked drop in contributions from those who contributed the most initially. In the final period they contributed an average of 97c, down from an average of 149c in the initial phase. Figure 4b suggests that institutional crowding is occurring as a result of those who were initially making the largest contributions subsequently contributing less. The effect is much less marked among those who were making smaller, but still greater than Nash, contributions (51-99c).

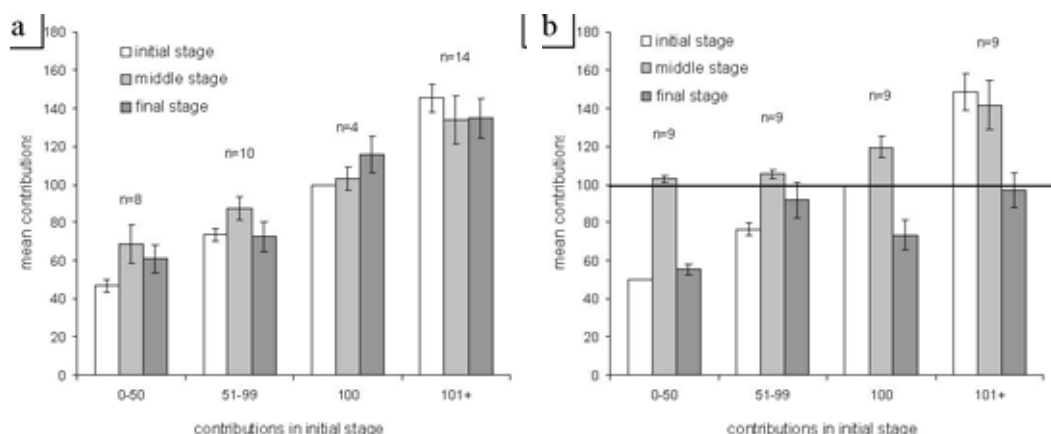


Figure 4: Contributions by individuals in each phase (means \pm standard errors), grouped by contributions in the first phase in the suasion (left) and the regulation treatment (right).

Discussion

The results of these experiments indicate that simple institutional changes can have significant impacts on voluntary contributions to a public good. In terms of motivations, in the initial stage there were no formal incentives to contribute. Individuals who did so may have been motivated by reciprocity – by contributing themselves they may have encouraged others to contribute more, resulting in a higher payoff in subsequent periods. As discussed above, they may also have been motivated by social norms to make some level of contribution, or by a subconscious desire for approval. (While the experimental setting means decisions are anonymous, instinctively people may still feel subject to social pressures.) Another largely intrinsic motivation is self-image, people wanting to do ‘the right thing’. Some or all of these motivations appear to have been crowded out by the regulation. Contributing to the public good because you are being compelled is unlikely to provide the same ‘warm glow’ or social approval as making entirely voluntary contributions.

Overall contributions were lowest in the control treatment. Beginning from a low base, contributions declined through the periods, reaching the level of the Nash equilibrium before the end of the session. Unlike the other treatments, the control proceeded through all 12 periods without interruption, so there was no possibility of a restart effect – stopping, and then resuming a public goods game has been shown to result in a jump in voluntary contributions (Andreoni 1988). The inclusion of a single sentence of moral suasion had a dramatic effect on voluntary contributions. It did not contain any new information, although it may have made the trade-off between private and public income clearer to some participants. Alternatively it may have served as a coordinating device by suggesting an initial level of contribution, or creating a social norm for higher contributions in the minds of some participants.

The decline in contributions over the four periods within each stage is particularly notable in the suasion treatment, yet after the suasion page was repeated, contributions returned to their original levels. It is curious that the effect of suasion appears to wear off so rapidly, yet is so easily reproduced. Each period lasted for less than two minutes, so participants hardly have time to forget the suasion information. It is almost as though they pretend to forget that they should be contributing, but the reminder forces them to resume their contributions. Not contributing, when one knows one should, may be financially beneficial but detrimental to one’s self image. Such a conflict could be avoided by ‘forgetting’ that it is right to contribute. This is analogous to finding a reason for crossing the street when a charity collector is spotted up ahead.

Expanding on the findings of Frey and Oberholzer-Gee (1997), these experiments provide

support for the hypothesis that experience of a formal institution can crowd out voluntary contributions to a public good. Contributions in the final stage of the suasion only treatment were significantly higher than in the suasion plus regulation treatment, even though the regulation had been discontinued by this point. The effectiveness of an institution, in this case suasion only, depended on what had preceded it. Büchner *et al.* (2004) point to the importance of institutional sequencing. In an experimental comparison, a formal and informal incentive scheme had a similar effect when experienced in isolation, but substituting the formal in place of the informal had a strong negative effect on effort invested, while the opposite change had a strong positive effect (Büchner *et al.* 2004). Therefore experiments which consider only a single institution in isolation may be missing important aspects of how people respond as it is introduced.

The potential negative effects of regulations were demonstrated in a field experiment in which a group of day care centres introduced a small fine for parents who arrived late to collect their children, resulting in the incidence of late arrivals doubling (Gneezy & Rustichini 2000). Initially, parents are likely to have been intrinsically motivated by social norms to avoid inconveniencing centre staff, but this appears to have been weakened by the introduction of the formal rule, and the small fine (cUS\$3) in itself provided a weak incentive to arrive on time. After the regulation was removed, the rate of late arrivals remained at the higher level, suggesting that the effects of crowding out may be difficult to reverse (Gneezy & Rustichini 2000).

Interestingly, in our experiment enforcement of a minimum contribution did not reduce the contributions made by those who had previously been contributing above the regulatory requirement. Crowding out of voluntary contributions only became apparent after the regulation was discontinued. The introduction of any regulation draws attention to the fact that other people may not be conforming to a social expectation. Those who contributed more in the early periods may have seen the introduction of the regulation as a way of ensuring “fairer” contributions, in which case removing it may be seen as a violation of that fairness ideal. From this it could be concluded that moving from what may be seen as a “fair” system to an “unfair” system may negatively impact on motivations to contribute.

Once the regulation was removed, and with the realisation that some may not have been contributing, the social goodwill, warm glow of self-awareness or notions that everyone would contribute may have been replaced with notions of inequality and expectations of unjust outcomes. If a person perceives that *others* are less likely to contribute, they may feel there is less to gain from promoting reciprocal contributions. Superficially, prior institutional experience ought not to affect motivations for reciprocity. However, voluntary contributions have been shown to be positively correlated with beliefs about how much other group members will contribute (Croson 1999). Therefore people may seek to match the lower contributions they expect from others.

Experiment Two: Competitive Market Institution

This experiment focussed on the introduction of a market institution, in the form of a competitive tender, to a public goods dilemma. In the tender, participants are given the opportunity to submit bids to receive extra payments in return for contributing to the public good in the following decision period. A limited budget is available for making such payments, which is allocated to the cheapest bids. This provides participants with an additional incentive to contribute to the public good and creates a competitive market environment. In this context we questioned a) whether people continue to express social preferences through costly

voluntary contributions in the presence of a market institution; b) if people use the tender to subsidise additional contributions, cover the cost of existing contributions or rent seek; c) how people respond to unsuccessful offers; d) whether people return to pre-market levels of voluntary contributions after the market institution is removed; and e) whether the impact of the market varies depending on initial voluntary contributions (and therefore social preferences).

Experimental design and methods

Experiment two used the same scenario and basic methods as experiment one. The first four periods proceeded with no formal institution, creating a public goods dilemma in which many participants were making voluntary contributions. The competitive tender was introduced after period four. Participants had no prior warning that such a mechanism would be brought in, other than being told in the initial instructions that 'procedures may be changed during the experiment'. After period four was completed, participants were asked to read an additional set of instructions which detailed the tender mechanism. The tender used a discriminative price mechanism – successful offers received the price they requested, rather than a market clearing price. In each period, a fixed quantity of shared income was purchased.

The tender process was conducted at the beginning of periods 5, 6, 7 and 8. Participation in the tender was voluntary. Participants could offer to contribute a certain amount of shared income in that period, in return for a payment. They could choose how much shared income to offer (in blocks of 25 cents, up to the maximum contribution of two dollars) and how much extra payment they required in return. These payments were additional to the payments based on the option selected subsequently. Successful offers were funded exogenously, not from the shared income fund. Screens were updated after the offer process closed to show the results. Extra columns were added to the participants' screen to indicate how much shared income had been 'sold', and how much extra payment would be received during the trading periods.

Participants then had to select an option, as in the previous periods. If an offer was successful, a person was required to contribute at least that much shared income in their subsequent decision. For example, if someone successfully 'sells' 100 cents of shared income, they had to select an option that contributed at least 100 cents to the shared income fund, i.e. they could only choose from options 1-3 (the software blocked them from choosing options 4 or 5). If an offer was unsuccessful, a person could subsequently select any option. Offers were valid for the current period only. The offer process was repeated at the beginning of each period during periods 5-8. Only one offer could be entered per person per period. Participants only knew the outcome of their own offers. They did not know the total quantity bought or extra money paid.

Two budget treatments, in which different quantities of shared income were purchased, were used to stimulate greater or lesser degrees of competition. In the higher budget and lower budget treatments, ten dollars and seven dollars fifty cents respectively were available to fund offers in each period. After period eight, participants read another set of instructions in which they were told that the tender was being discontinued, and the experiment would continue in the same way as in the initial periods.

Results

In the pre-tender phase of the experiments, individual contributions to the public good averaged 85 cents per period, which is higher than the Nash equilibrium (50 cents) but considerably lower than the Pareto optimum (180 cents). During the tender phase, making an offer was voluntary, but on only four occasions (out of 288 opportunities) did participants not enter offers when given the opportunity. The quantity of public good contributions offered in the

competitive tender was significantly higher than voluntary contributions in the pre-tender phase ($p < 0.001$). The mean quantity offered by each participant was positively correlated with contributions in the first phase ($p < 0.001$) and negatively correlated with their relative opportunity cost of contributing ($p = 0.028$). Quantity offered was not correlated with price ($p = 0.888$) and did not differ significantly between the two tender treatments ($p = 0.6$). The mean price requested was not significantly correlated with contributions in the pre-tender phase ($p = 0.165$). Mean price was significantly lower in the more competitive (lower budget) treatment than in the less competitive (higher budget) treatment ($p = 0.026$).

The vast majority (94%) of offers were priced in excess of the opportunity cost associated with their total proposed contribution (reduction in private income associated with contributing that level of shared income). Therefore, few were using the tender mechanism to subsidise additional contributions. Rent seeking was significantly greater in the higher budget treatment than the lower budget treatment ($p = 0.007$). On average offers were priced 20 cents higher than the opportunity cost in the lower budget tender and 30 cents higher in the higher budget tender. There was also a significant negative relationship with relative opportunity cost ($p < 0.001$), which is to be expected as those participants with lower opportunity costs had far greater opportunities for rent seeking.

In the higher budget tender only 15% of offers were unsuccessful, compared to 36% of offers in the lower budget tender. Individual-level data from the lower budget (more competitive) tender were examined in more detail. In 84% of cases where offers were unsuccessful, contributions in subsequent decisions were at Nash (as opposed to only 47% overall). This indicates that those participants with failed offers were unwilling to make costly voluntary contributions, even if they had been doing so before the tender institution was introduced. Individuals who had been unsuccessful in the previous tender period lowered their prices by an average of 4.18 cents per block in the next round of the tender, while those who had succeeded raised their prices by an average of 0.94 cents.

Participants who had more of their offers accepted contributed significantly more to the public good during the tender phase ($p = 0.001$). Examination of individual contributions following each tender period revealed that those who were successful contributed on average 15 cents more than in the pre-tender phase, while those who were unsuccessful reduced their contributions by 35 cents on average (Figure 5). Success during the tender was not a significant determinant of contributions in the post-tender phase ($p = 0.1$).

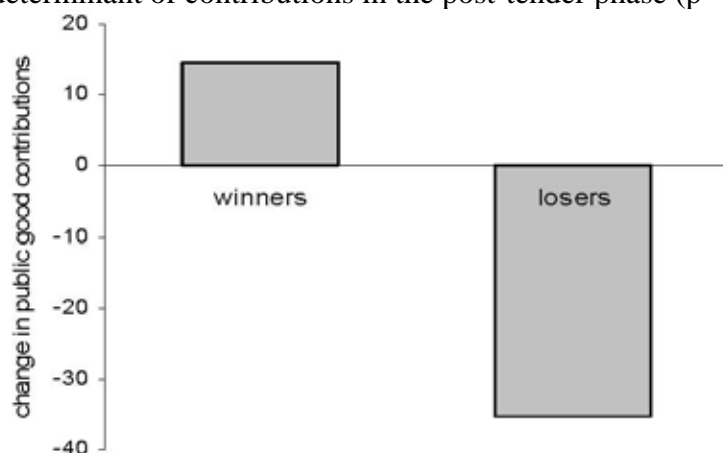


Figure 5: Mean changes in contributions to the public good following each round of the lower budget tender, compared to mean decisions made by the same participant in the initial phase of the experiment.

In the control treatment average contributions were the same across the three phases of the experiment ($p = 0.77$). In the pre-tender phase, contributions were not significantly different

between the control and tender treatments ($p = 0.08$). In the post-tender phase, contributions were significantly lower in the tender treatments compared to the control ($p < 0.001$). Figure 6 presents the mean individual contribution across the different phases of the experiment and high and low budget treatments. The associated Table 3 presents the contribution mean differences between the treatments and phases. Within the higher budget treatment, contributions were higher in the tender phase compared to the pre-tender phase⁶. In the post-tender phase, contributions were significantly lower than the tender phase, but not significantly different from the pre-tender phase. Within the lower budget treatment, contributions in the tender phase were not significantly different to those in the pre-tender phase. Contributions in the post-tender phase were, however, significantly lower than in the pre-tender and tender phases. Pre-tender and post-tender contributions were not significantly different across the two budget treatments. During the tender phases, contributions were significantly greater in the higher budget treatment compared to the lower budget treatment.

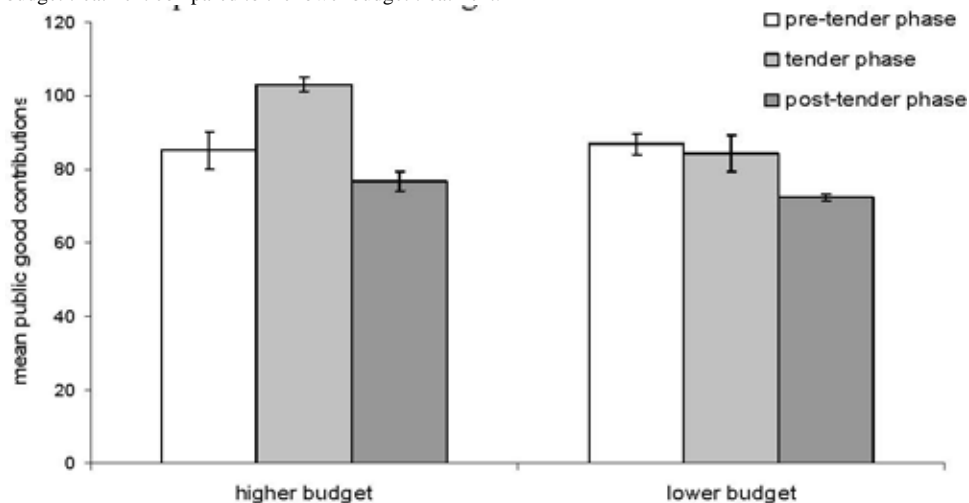


Figure 6: Mean (+/- standard errors) individual contributions to the public good, for each phase of the experiment.

		Higher Budget					
				Tender	Post-tender	Pre-tender	Tender
Higher Budget	Pre-tender	18.1**	-8.33	1.7	-0.7		
	Tender		-26.89***	-16.3**	-18.8**		
	Post-tender			10.1	7.6		
Lower Budget	Pre-tender				-2.43		
	Tender						

Lower Budget
Post-tender
-12.8*
-30.9**
-4.5
-14.6**
-12.2*

Table 3: Differences between mean contributions, by budget and phase. * indicates p significant at 0.05; ** 0.01; *** 0.001

The effect of changing institutions on individual contributions to shared income was examined by dividing individual subjects into four groups based on their average contributions in the pre-tender phase. The groups were defined by mean contributions: a) greater than 100 cents; b) equal to 100 cents; c) between 51 cents and 99 cents; d) less than or equal to 50 cents. Figure 7 presents the mean individual contribution across phases and treatments for each group. The associated Table 4 presents the differences in mean contribution between phases within each

group. Within the higher budget treatment, for those who initially contributed less than 50 cents, the mean contribution was significantly higher in the tender phase compared to the pre-tender and post-tender phases. The mean contribution in post-tender phase was not significantly different to that from the pre-tender phase. For those who initially contributed between 51 and 99 cents, the mean contribution during the tender phase was significantly higher than during the pre-tender phase. The mean contribution pre-tender equalled the mean contribution in the post-tender phase. In the high budget treatment there was no significant difference in the mean contributions in those groups which contributed 100 cents or more.

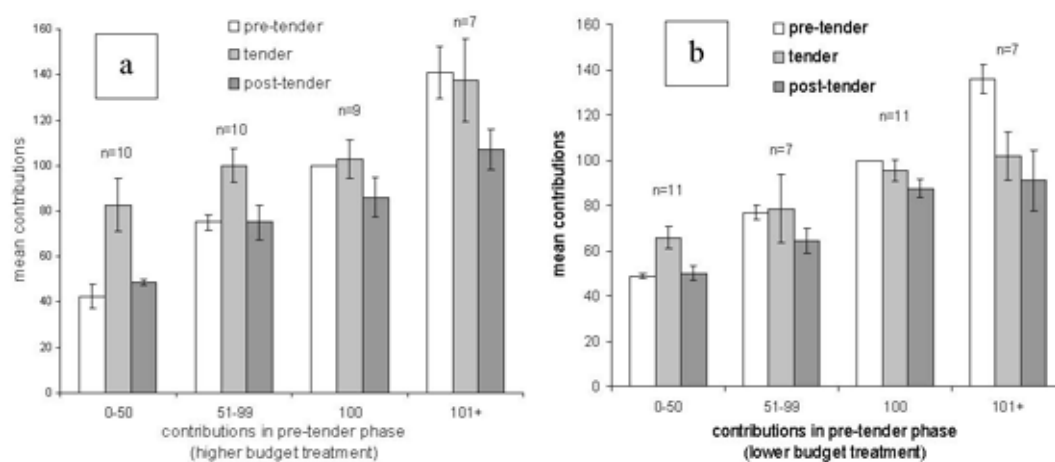


Figure 7: Mean contributions (+/- standard errors) by individuals in each phase, grouped by contributions in the pre-tender phase.

Within the lower budget treatment, for those who initially contributed less than 50 cents, the mean contribution during the tender phase was significantly greater than during the pre-tender and post-tender phases. There are no significant differences in the mean contributions of those who initially contributed between 51 and 99 cents. In contrast, for those who initially contributed 100 cents or more, mean contributions during the post-tender phase were significantly less than in the pre-tender phase. For those who initially contributed more than 100 cents, the mean contribution during the tender phase was significantly higher than during the pre-tender phase.

Group	Higher budget			
	Pre-tender	Tender	Post-tender	Tender
0-50 cents	Pre-tender	40.0***	6.3	17.1***
	Tender	-33.8**		
51-99 cents	Pre-tender	25.0*	-25.0*	1.79
	Tender	0.0		
100 cents	Pre-tender	2.8	-13.9	-4.55
	Tender	-16.7		
> 100 cents	Pre-tender	-3.6	-33.9	-33.9*
	Tender	-30.4		

Lower budget
Post-tender
1.1
-15.9**

-12.5
-14.3
-12.5*
-8.0
-44.6**
-10.7

Table 4: Differences in mean contributions by group, phase and budget. * indicates p significant at 0.05; ** 0.01; *** 0.001

Discussion

These results support the concept that the introduction of a market triggers a significant number of people to switch to a different behavioural paradigm. In the early periods of the experiment, in the absence of any formal institution or material incentive structure, many participants were prepared to make costly contributions to the public good. Under the competitive tender, participants had the opportunity to make offers for payments for contributing. Rather than using the tender as a chance to subsidise existing levels of contributions, or offset the costs of making larger contributions, participants were attempting to profit from contributing to the public good. Those whose offers were unsuccessful typically contributed nothing, even if they had previously been making voluntary contributions in the absence of any payment mechanism.

The introduction of the market institution appears to have triggered a ‘market instinct’, with participants abandoning the social preferences they were previously expressing and becoming self-interested profit maximisers. Interestingly, there appeared to be no middle ground – while the market was in place the vast majority of participants sought to maximise their personal income. Prior to the introduction of the tender, the public goods dilemma elicited a range of responses, as is typical for such games, with some participants playing the Nash strategy while others were making substantial voluntary contributions. In such dilemmas, many people find it difficult to know what is the ‘right’ course of action. During the tender phase there was little evidence of uncertainty – people appeared to recognise the situation as a market⁷ and responded accordingly.

The vast majority of offer prices were in excess of opportunity cost. This suggests that participants were using the tender as a rent seeking mechanism. People who had been making voluntary contributions in the pre-tender phase were now seeking to profit from contributing. Participants did not appear to use the tender as a means of reducing their costs from making ongoing (or increased) voluntary contributions, but rather as a means of increasing their personal income. The observation that many of those who had been successful in the previous tender period subsequently increased their asking price again suggests that participants are rent seeking, rather than simply offsetting the costs of contributing. This behaviour will also tend to erode the surplus extracted from discriminative price auctions (Schilizzi 2004).

Overall most individuals made very conservative offers, contributing only small amounts to the public good. Success in the tender was associated with a 15c increase in contributions, which is relatively small compared to the average voluntary contribution of 85c in the pre-tender phase. Those who were unsuccessful contributed an average of 35c less than they had in the pre-tender periods. Having missed out on the chance of an extra payment, it is intuitively, if not theoretically, unsurprising that these individuals are subsequently less motivated to contribute, particularly as they know that others are getting paid for contributing. The competitive tender process may be seen as inequitable (Schilizzi 2004), something that experimental participants, and even other primates, have a strong aversion to (Fehr & Schmidt 1999; Brosnan & de Waal 2003). The tender may also create an expectation of payment, making people unwilling to contribute without being paid.

Prices were significantly lower in the more competitive (lower budget) tender than in the higher budget tender, indicating that participants were modifying their offer prices based on previous experience. All participants continued to make offers throughout the experimental tender, even though it was not compulsory to do so. This may be an artefact of the experimental design, as entering offers was costless. In reality, there are costs in terms of time and possibly professional advice, associated with submitting offers in such tenders. Incurring such costs may accentuate the negative motivational impact on unsuccessful participants. In a costly offer process, those who are unsuccessful may also stop participating in subsequent periods. This could be explored in the laboratory by assigning a cost to submitting an offer.

Voluntary contributions in the post-tender phase were significantly lower overall than during the pre-tender phase. This suggests that experience of the market institution, even in the absence of the market itself, has crowded out any social preferences that were previously being expressed. While introducing a market institution triggers the expression of self-interest rather than social preferences, it appears to be less straightforward to move in the opposite direction. Just as in experiment one, the effects of crowding outlast the institution itself, and the use of formal incentives to promote the provision of a public good carries with it a risk of an adverse, and lasting, loss of intrinsically motivated contributions.

The impact of the tender on individual contributions to the public good varied markedly depending on how much a person had been contributing prior to its introduction. Those who had been contributing at or around the Nash equilibrium (50 cents) in the pre-tender phase on

average raised their contributions during the tender phase. The tender was providing the incentive for these people to make larger contributions; when the tender was removed they returned to their original level of contributions, around the self-interested Nash equilibrium. By contrast, those who had been making large voluntary contributions in the pre-tender phase did not on average increase their contributions during the tender. In fact, in the lower budget tender there was a significant decrease in contributions from this group, reflecting negative responses to unsuccessful offers. Removal of the tender did not cause contributions to return to their original levels.

In a market, there is a clear measure of success in the form of price. Paying too much, or selling for too little, may trigger regret, even if the trade was profitable. Such trades may be considered as a loss, which is weighted much more heavily than gains in the minds of most traders. Additionally, people have a psychological need to feel competent at an activity. In a market, this is likely to be expressed by getting the best price possible. In other situations, people may feel competent by contributing to the public good if that is perceived as the 'right' thing to do. Therefore, people are likely to learn to express mainly self-interested preferences under market-like institutions. Experimental evidence suggests that the more a situation resembles a competitive market with multiple anonymous buyers and sellers, the less other-regarding behaviour will be observed (Bowles 1998).

Pro-social behaviour is promoted and rewarded in situations where there are repeated interactions under incomplete contracts. In perfect markets with anonymous, once-off interactions and complete contracts, there is little institutional support for pro-social preferences. Therefore it should not be surprising that people switch to self-interested behaviour when a tender is introduced. However, in many markets, social preferences may retain a significant role. Unlike typical experimental scenarios, many markets are neither anonymous nor limited to once-off interactions, and contracts are seldom complete due to the high transaction costs involved. Under these conditions, trust and other-regarding preferences evolve (Bowles 1998). Strengthening formal institutions may lead to reduced investment in relationship building and trust, and there may therefore be multiple equilibria sets of norms and contracts (Bowles 1998). Yamagishi and Yamagishi (1994) suggest that the lower levels of general trust observed from survey and experimental data in Japan compared to the USA can be explained by the existence of stronger institutions in Japan; within those institutions levels of trust can be very high, but outside them it is low.

The assumption that institutions do not affect preferences is useful for providing a common framework for analysis, but it is not realistic (Bowles 1998). Institutions can both shape motivations and determine which behavioural paradigm is followed. For instance 'friendly' institutions are likely to enhance values for positive reciprocity, while 'hostile' institutions will have the opposite effect. Institutions also frame whether a situation is cooperative or competitive, which determines which preferences and norms people apply. Cooperation in social dilemmas tends to be fragile, and can be adversely impacted by competition (Pillutla & Chen 1999). Therefore as institutions change, motivations and behaviour may also change, which has important implications for the provision of public goods.

Policy Implications

Theoretical and empirical evidence shows that economic decisions are shaped by a range of motivations. Unfortunately for policymaking, these motivations are not always additive. This complicates the design of policies to promote the provision of public goods. In situations where intrinsic motivations are low, and few voluntary contributions are being made, extrinsic incentives can significantly increase supply of a public good. However, where some people are already making voluntary contributions there is a danger that introducing extrinsic incentives will crowd out intrinsic motivations. In such circumstances, policies intended to promote public good contributions may be ineffective, or even result in an overall decline in supply. Once the warm glow or social approval is separated from an activity, it may be difficult to recover, so poorly designed policies will continue to cause problems even after they are removed.

Crowding out was particularly severe with the introduction of the tender. The competitive institution triggered a market instinct, with participants striving to maximise their financial self-interest, as they are accustomed to doing in other markets. In many circumstances this will be beneficial, as markets have a proven ability to reveal information and allocate resources efficiently. However, any pre-existing spirit of volunteerism may be lost. In our experimental scenario, there was no increase in public good provision following the introduction of the lower budget tender, even though additional funds were being paid out as incentives. Furthermore, after the market was removed, overall contributions fell significantly, suggesting that once people's perceptions have changed it may not be straightforward matter to change them back.

In our experiment the impact of the market incentive varied with initial preferences and behaviour – it had a positive effect on those who were previously not contributing, and a negative effect on those who were making costly voluntary contributions. This suggests that, if all participants are initially self-interested, a market will, as theory predicts, increase contributions by providing an additional incentive. However, if a substantial number of participants are motivated by social preferences to make costly voluntary contributions, a market will be less effective than anticipated. Therefore, policy makers should consider existing preferences and behaviour when deciding if and how to introduce a market-based policy instrument.

Policy design has much to gain from a better understanding of existing voluntary behaviour and motivations. Some incentives have the potential to crowd in intrinsic motivation by recognising and acknowledging it (Frey 2001). Well designed policies may therefore be able to strengthen existing intrinsic motivations among those already contributing, while also providing attractive extrinsic incentives to encourage others to contribute. Other incentives can do more harm than good; they are costly to implement and can actually cause a net decline in public good provision, which may persist even after the incentive is discontinued. Policy makers should therefore tread carefully when introducing formal institutions into the mix of informal institutions and motivations that surround public goods.

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